Natural Sisal Fibre Reinforced Concrete with Experimental Studies

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ABSTRACT: Concrete is strong in compression and weak in tension. So we will provide the reinforcement to the concrete. Majorly steel is used as the reinforcement. Many of the researches are in progress to find a substitute to this material. Many investigations proposed artificial fibres. In this project we would like to take the naturally available fibre named sisal fibre is taken as a substitute material to the reinforcement and studied the propertie.The results show that the composites reinforced with sisal fibres are reliable materials to be used in practice for the production of structural elements to be used in rural and civil construction. This material could be a substitute to the steel reinforcement which production is a serious hazard to human and animal health and is prohibited in industrialized countries. The production of sisal fibres as compared with synthetic fibres or even with mineral asbestos fibres needs much less energy in addition to the ecological, social and economical benefits.

Keywords: sisal fibre, asbestos fibres, compression & tensile strength.

1. Introduction

Natural fibres are prospective reinforcing materials and their use until now has been more traditional than technical. They have long served many useful purposes but the application of materials technology for the utilization of natural fibres as the reinforcement in concrete has only taken place in comparatively recent years. The distinctive properties of natural fibre reinforced concretes are improved tensile and bending strength, greater ductility, and greater resistance to cracking and hence improved impact strength and toughness. Besides its ability to sustain loads, natural fibre reinforced concrete is also required to be durable. Durability relates to its resistance to deterioration resulting from external causes as well as internal causes**.**

Fig 1 Sisal Fibre extraction

1.2 Generally the fibers are classified in to two types

They are artificial fibers and natural fibers. In the artificial fibers steel, asbestos, glass, carbon, synthetics etc are used and in the natural fibers horse hair, sisal, coir, bamboo, jute, aware, elephant grass, coconut fibers etc are used and in this human hair was used as a fiber. Human hair is natural fiber and it is strong intension.

Fiber reinforced concrete has so far been successfully used in slabs on grade, architectural panels, precast products, offshore structures, structures in seismic regions, thin and thick repairs, crash barriers, foot0ings, hydraulic structures and many other applications. Fiber Reinforced Concrete (FRC) is gaining attention as an effective way to improve the performance of concrete. Fibers are currently being specified in tunneling, bridge decks, pavements, loading docks, thin unbounded overlays, concrete pads, and concretes slabs. These applications of fiber reinforced concrete are becoming increasingly popular and are exhibiting excellent performance. Fiber-reinforced concrete (FRC) is concrete containing fibrous material which increases its structural integrity. It contains short discrete fibers that are uniformly distributed and randomly oriented. Fibers include steel fibers, glass fibers, synthetic fibers and natural fibers this study presents understanding strength of fibre reinforced concrete. Mechanical properties and durability of fiber reinforced concrete.

1.3Scope

Concrete is strong in compression and week in tension. To increase the tensile strength of concrete we are adding sisal fibre. Also it resists the plastic shrinkage cracks. This sisal fibre is a natural product that is available in the fields and if this could replace the reinforcement in the concrete it would be a gigantic change in the construction industry.

1.4 Objective

The main objective is to study the effect on utilization of sisal fibre in the concrete as the reinforcement and in this investigation the fibre is mixed in different proportions by cutting it into small pieces of size 3 to 5 cm.

To study the mechanical and transport properties of concrete

1. Compressive test on concrete cubes (150 × 150 × 150 mm)
2. Split tensile strength on cylinders (Ø 100 mm & 200 mm long)
3. Evaporation test on cubes (150 × 150 × 150 mm)
4. Water absorption test on cubes (150 × 150 × 150 mm)
5. Moisture migration test on cubes (150 × 150 × 150 mm)

2. Literature Review

M. A. Aziz, P. Paramasivam and S. L. Lee 1984: Natural fibres are prospective reinforcing materials and their use until now has been more traditional than technical. They have long served many useful purposes but the application of materials technology for the utilization of natural fibres as the reinforcement in concrete has only taken place in comparatively in recent years. The distinctive properties of natural fibre reinforced concretes are improved tensile and bending strength, greater ductility and greater resistance to cracking and hence improved impact strength and toughness. Besides its ability to sustain loads, natural fibre reinforced concrete is also required to be durable. Durability relates to its resistance to deterioration resulting from external causes as well as internal causes.

Mechanical characterization and impact behaviour of concrete reinforced with natural fibres were studied by S.K. Al-Oraimi and A. C. Seibi (1995). Here an experimental study was conducted using glass and palm tree fibres on high strength concrete. Mechanical strength properties such as compressive, split tensile, flexural strengths and post cracking toughness were studied. It was concluded that natural fibres are comparable with glass fibres. A finite element analysis was also done using ANSYS software. Both analytical and experimental results were compared an acceptable.

G.Ramakrishna and T. Sundararajan (2002). Flow value, cohesion and angle of internal friction were determined for three different mix ratios and four different aspect ratios and fibre contents. Based on the rheological properties of fresh mortar, it was recommended to use shorter fibres with low fibre- content for achieving workability and higher fibre content for better cohesiveness in wet state.

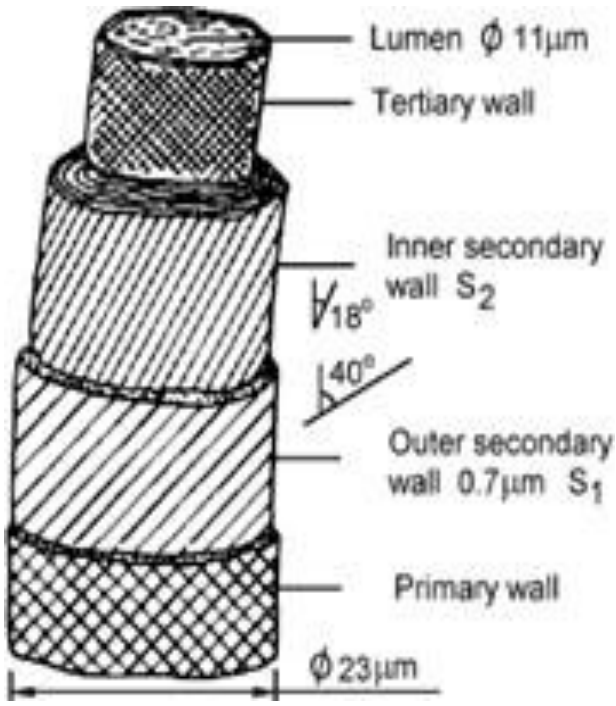


Fig 2. Schematic sketch of a sisal fibre

3. MATERIALS AND PROPERETIES

Cement: OPC 53 grade cement from a single batch will be used throughout the course of the project work. The properties of cement used are shown in table below.

Table 4: Physical Properties of Sisal Fibre

S. no	Particulars	Results
1	Diameter	0.2mm
2	Elongation	4.3%
3	Water absorption	3%
4	Cellulose	70%
5	Tensile Strength	300 Mpa
6	Density	1.450gm/cm^3

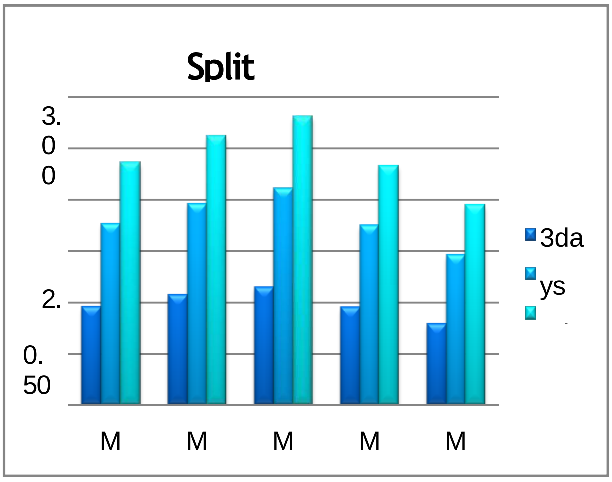
4. EXPERIMENTAL INVESTIGATION

4.1 SPLIT TENSILE STRENGTH

Split Tensile test is conducted on the cylinders of the sizes in ratio 1:2 to the diameter and length of the specimen. In this investigation totally 45 cylindrical moulds of size 100mm*200 mm were tested for knowing Split tensile strength of different mixes at 3 days , 7days, and 28 days.

Table 5 Split Tensile Strength for different mixes

Split Tensile Strength N/mm^2			
Mix	3 days	7 days	28 days
M1	0.96	1.77	2.36
M2	1.07	1.96	2.62
M3	1.15	2.11	2.81
M4	0.95	1.75	2.33
M5	0.79	1.46	1.95

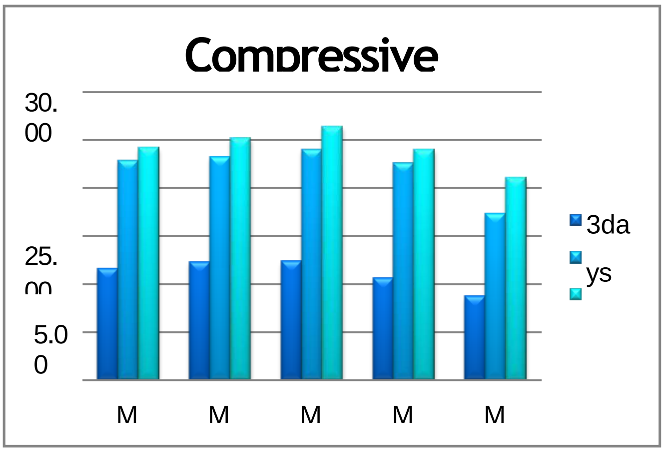


Graph 1. Shows the split tensile strength of concrete

4.2 COMPRESSIVE STRENGTH

Table 6 Compressive Strength of different mixes

Compressive strength N/mm^2			
Mix	3days	7 days	28 days
M1	11.57	22.81	24.22
M2	12.31	23.19	25.19
M3	12.34	24.00	26.44
M4	10.61	22.59	24.00
M5	8.67	17.33	21.04



Graph 2. Shows the Compressive strength of concrete